

R&D Services Directorate Completes SOFIA Lower Flexible Door

By Dr. Gerald Mulenburg

The Ames Research Center & Services Directorate met a significant milestone for the Stratospheric Observatory for Infrared Astronomy (SOFIA) program when it completed the Lower Flexible Door assembly. A major Ames program, the 2.5 meter SOFIA infrared telescope will be mounted in a Boeing 747 aircraft that will be home-based at Ames and deployed around the globe to observe far-infrared wavelengths of supernovae and the composition and structure of comets and planetary atmospheres. As described in the June issue of Aerospace America, "On a starry night in October 2004, two aerodynamically designed doors will blink open on the fuselage of a refurbished 747 airliner cruising at 41,000 feet."

Designed and fabricated entirely at Ames for the Universities Space Research Association (USRA), the Lower Flexible Door successfully completed its final load testing at Ames and received approval for conformity to FAA requirements prior to shipment to Waco, Texas for installation in the SOFIA 747 aircraft. Facing significant challenges in creating a one-of-a-kind door for the SOFIA telescope cavity that can repeatedly be opened and closed during flight, the Ames' team from the Systems Engineering Division and the Hardware Development Division led by Dave Ackard and Bill Caldwell respectively, worked as a co-located, cross-functional team. The team of engineers and fabrication craftsmen from the two divisions worked in a major collaborative effort to create the door design, and develop the fabrication techniques necessary, to meet the unique requirement of the door's configuration to flexibly adjust to the shape of the 747's lower fuselage, which isn't a circle but an ellipse.

Developed as a multiple-panel flexible design, the 8 foot tall and 14 foot wide door not only must move smoothly during its open-close travel cycle, it has to do it under the maximum operating load conditions that will be experienced during flight. This is not unlike opening and closing your garage door in a 250-mile per hour wind at -70 degrees Fahrenheit. Modifications to the Ames' fabrication equipment developed by Mr. Ackard, and the development of precision assembly fixtures to position the hardware during assembly ensured that the high tolerances necessary for repeatability of each door panel were met. In meeting these exacting requirements, and to test the strength of the door, a prototype door design was developed to FAA standards. Upon completion of prototype testing and FAA approval of the door design and fabrication processes, the R&D Services team received FAA go-ahead to fabricate the flight-hardware door for the aircraft and successfully tested it with 21,000 pounds loaded across its length (twice the expected flight load). As stated by Caldwell, "Successful completion of the Lower Flexible Door exemplifies the reasons why the SOFIA Program is resorting to NASA internal resources for the development of such critical systems." This same team is continuing to support the SOFIA program in developing other major elements of the cavity door system, as well as telescope and science instrument equipment.

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